

# The willows (*Salix* – Salicaceae) in Tasmania

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Matthew L. Baker

Tasmanian Herbarium, Private Bag 4, Hobart, Tasmania 7001, Australia.

e-mail: matthew.baker@tmag.tas.gov.au

## Introduction

The genus *Salix* (willows) has a widespread native distribution concentrated mainly in temperate to sub-arctic regions of the Northern Hemisphere, but scattered in Argentina, Chile, South Africa and Madagascar. Some species are native in tropical areas of central America, Africa and south-east Asia. The genus is not native in Australasia. Recent estimates suggest that *Salix* contains 300–520 species (Cronquist 1988; Newsholme 1992; Argus 1997; Mabberley 1997; Fang *et al.* 1999). Together with the genus *Populus* L., it is in the family Salicaceae Mirb. Sometimes a third genus, *Chosenia* Nakai is also recognised, although this is often subsumed within *Salix*. The taxonomy of the Salicaceae, discussing generic limitations, is given by Skvortsov (1999) and Ohashi (2001). The Tasmanian taxa are in two subgenera: subgenus *Salix* (tree willows) and subgenus *Vetrix* Dumort. (shrub willows). Many species of *Salix* are used for timber production, basket making, soil stabilisation, windbreaks, fodder, medicine and as cultivated ornamentals. These practical values have significantly extended the distribution of the genus.

In Tasmania, several taxa of *Salix* have been widely planted and can be found as ornamentals in parks, gardens and open spaces such as roadside corridors. In rural areas, they are grown commonly for windbreaks and hedgerows, and on the banks of watercourses for consolidation. Several taxa are naturalised throughout the state whereas others have the potential to become naturalised. It is the principle aim of this paper to discuss the names that have been used in the past and to offer correct, or at least consistent, names for the plants that occur in Tasmania.

## History of *Salix* in Tasmania

Early records of *Salix* in Tasmania include Bunce (1836), a Tasmanian nursery catalogue thought to be the first of its kind in Australia; it cites 'Willow'. Another early record is in Newman's (1857) *Catalogue of Plants in the Royal Society's Gardens*, which lists two taxa: *S. babylonica* L. and *S. forbiana* (the latter possibly a plant now known as *S. xforbyana* Sm.). Both of these species are not known to grow in Tasmania today.

## Abstract

The genus *Salix* L. in Tasmania is wholly alien, having been introduced as cultivated plants. Several taxa have become naturalised, whilst others are potential sources of naturalised taxa. The naturalised taxa are: *S. fragilis* L. var. *fragilis*, *S. xreichardtii* A.Kern., *S. cinerea* L. subsp. *cinerea* and *S. cinerea* subsp. *aleifolia* (Sm.) Macreight. Taxa that are not fully naturalised are: *S. alba* L. var. *vitellina* (L.) Stakes, *S. xrubens* Schrank, *S. xsepulcralis* Simonk. nathavar. *chrysacama* (Dode) Meikle, *S. matsudana* Koidz., 'Tartuasa', *S. xcaladendran* Wimm., *S. purpurea* L. Taxa that are common in Tasmania but only known from cultivation are: *S. humboldtiana* Willd. 'Pyramidalis', *S. matsudana* × *S. alba* and *S. xpendulina* Wender. var. *pendulina*. The taxa are described and illustrated, and their identification, distribution, habitat and status are discussed.

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Since then, many willows have been introduced into Tasmania, sometimes as many as 100 taxa at a time. Two such introductions occurred in 1878 and 1880 (Anon. 1879; 1881), when large consignments were sent from Kew Gardens in Britain to the Royal Society Garden in Tasmania (now the Royal Tasmanian Botanical Gardens):

'...Plants and seeds received at the Botanic Gardens:—From the Royal Gardens, Kew, 100 varieties willow, most of which are alive...' (Anon. 1879).

'...From the Royal Gardens, Kew, was received a box containing upwards of 100 varieties of willow cuttings; but, unfortunately, arriving in the heat of summer all efforts to retain viability in them proved futile, and, with the exception of two varieties, all perished...' (Anon. 1881).

In more recent times, introductions of *Salix* to Tasmania include the importation of hybrid willows (*S. matsudana* × *S. alba*), developed in New Zealand for soil stabilisation and as windbreak species, and released to Australia in the 1970s (Cremer *et al.* 1995).

Although records, like the ones mentioned above, suggest that a large number of taxa have been introduced, only a relatively small number are commonly encountered in cultivation within the state.

Several *Salix* taxa are serious weeds across south-eastern Australia, including Tasmania. These problem species infest stream banks and wetlands. Their presence impacts negatively upon stream hydrology, displaces and modifies native biodiversity, and causes chemical imbalances in the waterways (ARMCANZ 2001).

There are two groups of naturalised willow in Tasmania. The first contains taxa that spread and become naturalised via vegetative reproduction. Of this group, *S. fragilis* var. *fragilis* is an extreme example. This species infests vast lengths of waterways in Tasmania and on mainland Australia. Its stems are very brittle, especially at the junctions, and break away from the parent plant when disturbed, for example in windy weather. These liberated stem fragments readily root and, if they come to rest in a suitable environment such as a stream bank, they will establish into mature plants. Detached stems of willows, in general, readily produce roots in moist conditions. Hence, other taxa with less brittle stems can also spread in this way. However, their spread is usually facilitated by cultivation rather than natural

means. The second group contains taxa that spread and become naturalised via sexual reproduction. Generally only a single sex of each taxon is present in Tasmania (exceptions include *S. cinerea*, *S. matsudana* × *S. alba* hybrids and *S. ×sepulcralis* nothovar. *chrysocoma*). For example, all *S. fragilis* var. *fragilis* plants in Tasmania are male. This restricts its reproduction to vegetative methods. The taxa that are present as both male and female plants can produce viable seed when growing together. In addition to this, willows can hybridise, allowing compatible taxa of opposite sex to breed. The seed that results from sexual reproduction has a tuft of fine, silky hairs enabling it to be transported by wind as well as on water currents. If transported to suitable habitats, such as wetlands and stream banks, the seeds can germinate and grow into mature plants. The ability of these plants to produce wind-borne propagules and be highly invasive in wet habitats makes them a significant weed threat in Tasmania. There is potential for some willows to reproduce and spread via both sexual and vegetative means. For example, *S. fragilis* var. *fragilis*, as mentioned above is highly adapted to spreading by fallen stems, it is also thought to have hybridised with *S. matsudana* 'Tortuosa'.

Prior to 1999, willows could be freely traded, propagated and planted throughout the state. The weedy nature of certain willow species, coupled with the large number of species that could possibly be introduced to Tasmania with unknown potential weed impacts, has seen the preventative regulation of the genus *Salix*, via the Tasmanian *Weed Management Act 1999*. Under this Act, all willows except for three taxa (*S. babylonica*, *S. ×calodendron* and *S. ×reichardtii*) are declared species in Tasmania. Management and control of the declared taxa depends heavily on an understanding of their taxonomy, biology, and ecology. In Tasmania, this information has been largely anecdotal and inconsistent, and it is the aim of this paper to clarify these details.

Published accounts of *Salix* relevant to Tasmania are Curtis (1967), Rodd (1982), Carr (1996) and Jacobs and Murray (2000), as well as the current *Census of Vascular Plants of Tasmania* (Buchanan 2007) – see Table 1. Curtis (1967) is strictly about *Salix* in Tasmania, but is based on very few Herbarium records. Rodd (1982), the *Flora of Australia* account, is also based on



**Table 1.** Summary of Tasmanian *Salix* taxa treated in previous works.

Curtis 1967*	Rodd 1982	Carr 1996	Jacobs & Murray 2000	Buchanan 2007	Baker 2009
<i>S. babylonica</i>	<i>S. babylonica</i>	<i>S. babylonica</i>	<i>S. babylonica</i>	<i>S. babylonica</i>	<i>S. xpendulina</i> var. <i>pendulina</i>
<i>S. alba</i> × <i>fragilis</i>	<i>S. fragilis</i> **	<i>S. xrubens</i>	<i>S. xrubens</i>	<i>S. xrubens</i>	<b><i>S. fragilis</i> var. <i>fragilis</i></b>
<i>S. atrocinerea</i>	<i>S. cinerea</i>	<i>S. cinerea</i> subsp. <i>cinerea</i>	<i>S. cinerea</i>	<i>S. cinerea</i>	<b><i>S. xreichardtii</i></b>
	<i>S. alba</i>	<i>S. alba</i> var. <i>alba</i>		<i>S. alba</i>	<b><i>S. fragilis</i> var. <i>fragilis</i></b>
		<i>S. fragilis</i> var. <i>fragilis</i>	<i>S. fragilis</i> var. <i>fragilis</i>	<i>S. fragilis</i>	<b><i>S. fragilis</i> var. <i>fragilis</i></b>
		<i>S. alba</i> var. <i>vitellina</i>	<i>S. alba</i> var. <i>vitellina</i>		<u><i>S. alba</i> var. <i>vitellina</i></u>
		<i>S. xsepulcralis</i> var. <i>chrysocama</i>	<i>S. xsepulcralis</i> var. <i>chrysocama</i>		<u><i>S. xsepulcralis</i> nothovar. <i>chrysocama</i></u>
					<b><i>S. cinerea</i> subsp. <i>cinerea</i></b>
					<b><i>S. cinerea</i> subsp. <i>oleifolia</i></b>
					<u><i>S. matsudana</i> 'Tortuosa'</u>
					<u><i>S. xrubens</i></u>
					<i>S. matsudana</i> × <i>S. alba</i>
					<u><i>S. xcalodendron</i></u>
					<u><i>S. purpurea</i></u>
					<i>S. humboldtiana</i> 'Pyramidalis'

\*Curtis (1967) also remarks that other species of *Salix* are cultivated in Tasmania and may be established locally.

\*\* Rodd (1982) states '...no Australian specimens appear to be pure *S. fragilis*, but the species is described here to assist recognition of hybrids between it and *S. alba*...'

Bold names under Baker (2009) are those considered to be naturalised in Tasmania. Underlined taxa are those that are not fully naturalised in Tasmania. The remainder are taxa that are commonly cultivated in Tasmania and have the potential to become naturalised as they have done in other Australian states.

very few Tasmanian records. Jacobs and Murray (2000) and Carr (1996) are accounts for New South Wales and Victoria respectively and do not discuss any Tasmanian distributions in detail.

## Materials and Methods

This paper includes treatments of Tasmanian taxa that commonly grow in habitats such as the banks of watercourses, lake/dam shores and other permanently or seasonally wet areas. At many locations, it is not clear whether the willows have been intentionally planted, and therefore are not naturalised, or whether they have arisen at the location and naturalised without human aid. In other instances, the plants may have been originally planted and subsequently spread so that a mix of cultivated and naturalised plants is present.

Descriptions of some taxa that are present in Tasmania as cultivated plants are also included on the basis that they are naturalised in other parts of the world (in particular south-eastern Australia and New Zealand) and have the potential to become naturalised in Tasmania. The naturalised status of treated species is based upon field observations made by the author and, when available, from notes accompanying herbarium specimens.

The definition of 'naturalised' follows Pysek *et al.* (2004). It refers to 'alien plants that sustain self-replacing populations for at least 10 years without direct intervention by people (or in spite of human intervention) by recruitment from seed or ramets (tillers, tubers, bulbs, fragments, etc.) capable of independent growth'.

The study is based mainly on recently collected specimens held in the Tasmanian Herbarium (HO),

material from other Australian Herbaria (CANB, MEL, NSW), exchange material from overseas herbaria, and comments on selected Tasmanian collections by British Salicologist Desmond Meikle. In the cases where Tasmanian material lacked morphological features the descriptions were supplemented using information from Meikle (1984).

Names that have been previously misapplied in the Tasmanian literature are listed where relevant. Whereas some of these are the result of misidentification of specimens that have been redetermined, others are literature references that appear to have not been based on critical examination of Tasmanian specimens.

Tasmanian distributions follow the floristic regions proposed by Orchard (1988). Geographical origins of the plants treated have been determined from various published sources.

The 'first record' indicates the earliest herbarium voucher of a particular taxon. In the case of naturalised taxa it is not always apparent, from the herbarium vouchers, that the specimens were taken from a cultivated or naturalised plant. It may also be speculated that the plants were naturalised well before the date of first collection. First records for taxa known only from cultivation are included for completeness and are not necessarily a good indication of the time the plant was introduced to Tasmania. To accurately determine the date of introduction of each of the taxa is beyond the scope of this paper.

Herbarium abbreviations follow Holmgren *et al.* (1990).

## Taxonomy

### *Salix* L., *Sp. pl. edn 1, 2: 1015 (1753)*

A formal description of the genus is given by Argus (1997), Fang *et al.* (1999), Jonsell (2000) and Ohashi (2001) and is not re-iterated here. A comprehensive discussion of the morphological characters of the genus is given by Skvortsov (1999).

The genus *Salix* spans a wide range of forms from low-growing, mat-forming *shrubs* through to large, wide-spreading *trees*. *Leaves* are simple, stipulate and petiolate, usually deciduous and alternate, although opposite to sub-opposite leaves occur in *S. purpurea*. *Flowers* occur in the axils of bracts and are gathered together in dense spikes or racemes commonly

referred to as catkins. Willows are usually dioecious but, in some taxa, including *S. xsepulcralis* nothovar. *chryscoma* and one of the *S. matsudana* × *S. alba* clones, the catkins often include both male and female flowers. The flowers have a greatly reduced perianth consisting of 1–2 nectariferous glands. Staminate flowers consist of one to many stamens (usually two in Tasmanian taxa), with filaments generally free. Pistillate flowers consist of a unilocular superior ovary with the ovaries either sessile or stipitate, each with 2–4, usually bilobed stigmas. The *fruit* is a 2–4-valved capsule that contains numerous seeds. Each seed has a tuft of fine silky hairs attached at its base.

Characters that distinguish *Salix* from other Tasmanian plants include the combination of the following characters: deciduous habit (*Salix humboldtiana* commonly retains its leaves throughout winter), sympodial growth (plants lack a terminal bud), buds with a single outer scale, flowers borne in catkins and a reduced perianth which consists of 1–2 nectaries.

Leaf characteristics given in this paper are based on mature leaves (material collected in summer and autumn before leaf fall) taken from exposed branches. Foliage from shaded areas of a plant, or that of strong regrowth, is generally of larger dimensions than material collected from unshaded areas.

Both mature leaf material and flowering material may be required to correctly identify some specimens. Mature leaf material (present in summer) and flowering material (present in early spring) occur at different times of the year, thus requiring two collections from the same plant.

Plant habit can be very diagnostic in the identification of willows. The following characters should be noted in the field when sampling: number of stems at or near ground level, size and shape of crown, and branch orientation.

### **1. *Salix fragilis* L. var. *fragilis*, *Sp. pl. edn 2. 1: 562 (1762)***

*Previously misapplied names:* *S. alba* × *S. fragilis* (Curtis 1967), *S. alba*, non-pure *S. fragilis* (Rodd 1982), *S. xrubens* (Carr 1996; Jacobs & Murray 2000; Buchanan 2007).

**Common name:** Crack Willow

**Illustrations:** Fig. 1A; 2A; 3

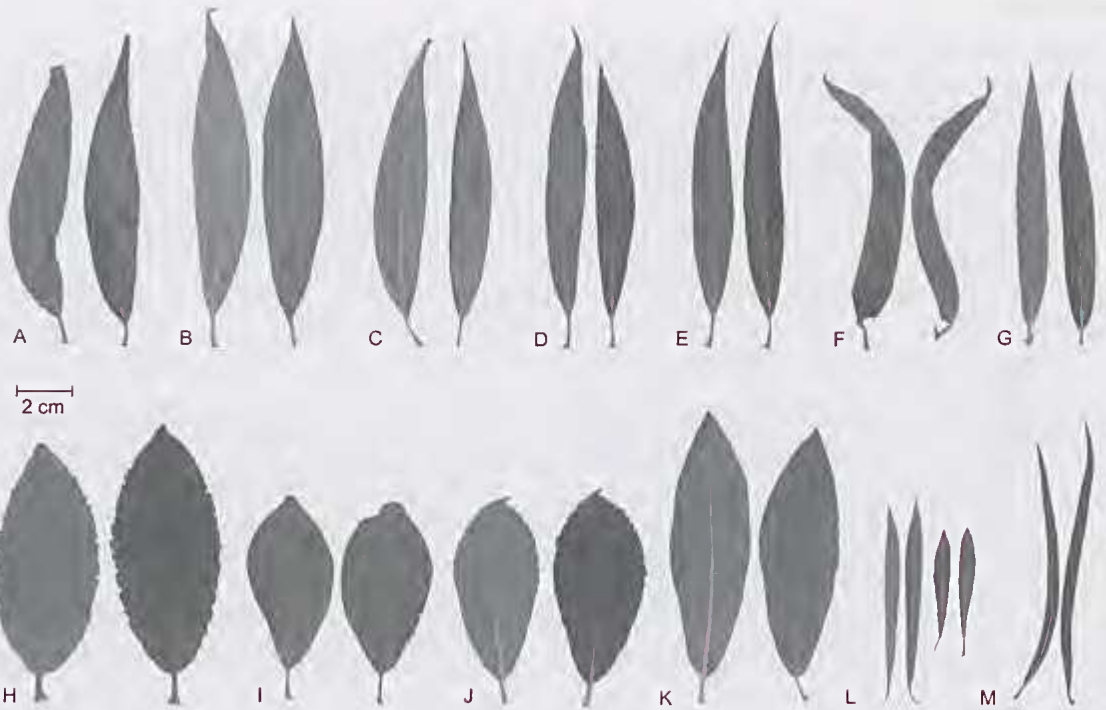


## Key to the taxa

- 1 Leaves linear, lanceolate or oblanceolate, more than three times longer than wide; large trees or shrubs, up to 25 m tall with one to many stems at base of plant; catkins  $\leq 13$  mm wide ..... 2
- 1: Leaves ovate to obovate, less than three times as long as wide; shrubs to small trees, up to 16 m tall, usually with many main stems at base of plant; catkins usually  $\geq 20$  mm wide (catkins of *S. xcalodendron* are  $<10$  mm wide; catkins of *S. xreichardtii* are 10–20 mm wide) ..... 10
- 2 Trees with fastigate crown; catkins not seen on mature plants ..... 13. *S. humboldtiana* 'Pyramidalis'
- 2: Trees or shrubs without fastigate crown; catkins always produced on mature plants ..... 3
- 3 Shrubs with opposite to sub-opposite leaves and stems; catkins usually  $\leq 20$  mm long ..... 12. *S. purpurea*
- 3: Trees with alternate leaves and stems; catkins usually  $> 20$  mm long ..... 4
- 4 Trees with contorted stems and leaves; catkins female ..... 6. *S. matsudana* 'Tortuosa'
- 4: Trees without contorted stems and leaves; catkins bisexual, male or female ..... 5
- 5 Branches strongly pendulous ..... 6
- 5: Branches erect to spreading or slightly pendulous ..... 7
- 6 Stems golden-yellow; catkins bisexual, male or female ..... 5. *S. xsepulcralis* nothovar. *chrysocoma*
- 6: Stems olive-brown to grey-brown; catkins female ..... 4. *S. xpendulina* var. *pendulina*
- 7 Branches slightly pendulous ..... 8
- 7: Branches erect to spreading ..... 9
- 8 Stems grey-green to reddish brown; mature leaves glabrous; catkins bisexual, male or female, 15–50 mm long ..... 7. *S. matsudana*  $\times$  *S. alba*
- 8: Stems golden-yellow; mature leaves with a persistent layer of fine, appressed hairs; catkins female, 60–75 mm long ..... 2. *S. alba* var. *vitellina*
- 9 Stems brown to olive-brown; leaves completely glabrous; catkins male; widespread species of rural and urban stream banks ..... 1. *S. fragilis* var. *fragilis*
- 9: Stems orange-yellow, reddish or brown to olive-brown; leaves usually with few persistent hairs; catkins male or female; occasional in both cultivation and resulting from *in situ* hybridisation between *S. fragilis* var. *fragilis*  $\times$  *S. alba* var. *vitellina* ..... 3. *S. xrubens*
- 10 Branches spreading, forming a crown that is usually rounded (i.e.  $\pm$  as tall as wide) ..... 11
- 10: Branches erect, forming a crown that is upright (i.e. taller than wide) ..... 12
- 11 Leaves lacking rust-coloured hairs ..... 9. *S. cinerea* subsp. *cinerea*
- 11: Leaves with at least some rust-coloured hairs ..... 10. *S. cinerea* subsp. *oleifolia*
- 12 Leaf margin strongly recurved, prominently undulate; stipules caducous; catkins male, ovoid ..... 8. *S. xreichardtii*
- 12: Leaf margin narrowly recurved, slightly undulate; stipules persistent; catkins female, cylindrical 11. *S. xcalodendron*

Trees to 25 m tall. Branches spreading, forming a rounded crown. Bark rough, coarsely fissured, grey. Stems thinly pubescent, soon becoming glabrous, brown to olive-brown. Bud scales sericeous, soon becoming glabrous, concolorous with the stems. Stipules mostly linear, caducous. Leaves linear-lanceolate to oblanceolate, sometimes asymmetric, 60–160(–200) mm long, 10–30

mm wide, sericeous, soon becoming glabrous; adaxial surface glossy; abaxial surface glaucous; margin glandular-serrulate; apex acuminate; petiole up to 15 mm long, with several glands at the lamina junction. Catkins appearing with the leaves on leafy side-shoots. Male catkins 40–60(–80) mm long, 10–13 mm wide, spreading to erect; peduncle up to 12 mm long; bracts



**Figure 1.** Leaf variation in *Salix* taxa: abaxial (left), adaxial (right). **A)** *S. fragilis* var. *fragilis*; **B)** *S. alba* var. *vitellina*; **C)** *S. x rubens*; **D)** *S. pendulina* var. *pendulina*; **E)** *S. x sepulcralis* nathavar. *chrysacama*; **F)** *S. matsudana* 'Tartuasa'; **G)** *S. matsudana*  $\times$  *S. alba*; **H)** *S. x reichardtii*; **I)** *S. cinerea* subsp. *cinerea*; **J)** *S. cinerea* subsp. *aleifolia*; **K)** *S. x caladendran*; **L)** *S. purpurea* (shawing variation); **M)** *S. humboldtiana* 'Pyramidalis'.

oblong, up to 2 mm long, pale yellow, pilose; stamens 2(-4), exceeding bracts in length, pilose at base. *Female catkins* not seen in Tasmania, but with similar general proportions to male catkins; ovary subsessile, pale green, glabrous. *Seed* not seen.

**Discussion:** For a comprehensive treatment of *S. fragilis* var. *fragilis*, see Meikle (1984). This species is not treated in Curtis (1967). However, I believe that the hybrid cross, *S. alba*  $\times$  *S. fragilis* (*S. x rubens*), that is described by Curtis (1967) as '...frequent along river banks and in wet places...' was misapplied to *S. fragilis* var. *fragilis*. *Salix fragilis* was described in Rodd (1982) but it is stated that no Australian specimens appear to be 'pure' *S. fragilis*. In the Tasmanian context, I believe that pure *S. fragilis* is very common. Furthermore, Rodd (1982) cites in his description of *S. alba* a Tasmanian specimen (Hayes, *W.M. Curtis s.n.*, HO) that I believe is *S. fragilis* var. *fragilis*. Subsequent Australian authors (Carr 1996; Jacobs & Murray 2000; Buchanan 2007), in my opinion, at least in part, attribute *S. x rubens* to

Tasmania on the basis of the above references and this has perpetuated the misapplication of that name.

Some nomenclatural controversy surrounds *S. fragilis*. Continental European Salicologists regard genuine *S. fragilis* as the wholly glabrous plant with pale clay-coloured twigs and red shoots, which British authors name *S. decipiens* Hoffm. or *S. fragilis* var. *decipiens* (Hoffm.) Koch; they regard what British Salicologists call *S. fragilis* as the hybrid *S. alba*  $\times$  *S. fragilis*, otherwise known as *S. x rubens* (Ib Christensen & Jonsell 2005; Meikle pers. comm. 2005). The concept of *S. fragilis* accepted in the present account is that of Meikle (1984).

Female catkin and flower characters have been taken from Meikle (1984). In Tasmania, only male *S. fragilis* var. *fragilis* plants are recorded. Carr (1996) and Jacobs and Murray (2000) list female characteristics but state that males are most common in both New South Wales and Victoria. Female plants are considered rare even in areas where *S. fragilis* var. *fragilis* is native (Meikle 1984). This species has stems that readily break



from the parent plant. Several authors (including Sykes 1988; Jacobs & Murray 2000) separate *S. fragilis* var. *fragilis* from other taxa by the fragile nature of the plant, commenting that the stems break with an 'audible crack'. Whilst the stems of *S. fragilis* var. *fragilis* are very brittle this characteristic is variable and can be present in other tree willows. This species can be distinguished from other large upright tree species such as *S. alba* var. *vitellina* and *S. xrubens* by having brown to olive-brown stems as opposed to orange-yellow to reddish stems in *S. alba* var. *vitellina* and *S. xrubens*. In both *S. xrubens* and *S. fragilis* var. *fragilis*, the rootlets immersed in watercourses are red. The leaves of *S. fragilis* var. *fragilis* become completely glabrous whereas the other two taxa usually retain at least some fine appressed hairs. Red-brown leaf galls caused by *Pontiana proxima* (Lepelletier), an exotic willow sawfly, are common on Tasmanian plants. This sawfly is not recorded from mainland Australia (Naumann *et al.* 2002; Finlay & Adair 2006).

The occurrence of tortuose and semi-tortuose saplings, that appear to have arisen from seed, at a site in Huonville, Tasmania (Baker 1711, HO), suggests that this species can hybridise with *S. matsudana* 'Tortuosa'; this has also been observed in specimens from Kyneton, Victoria (Baker 1637, HO). In Australia and New Zealand, this species has been recorded as hybridising with *S. alba* var. *vitellina* and *S. babylonica* (Sykes 1988; Jacobs & Murray 2000). Hybrids between *S. fragilis* and *S. alba* are discussed in detail under *S. xrubens*. Some *S. fragilis* plants at Launceston (Riverside) consist of male plants with flowers regularly bearing up to four stamens; these plants may be of a different origin to other material in Tasmania. In Victoria, *S. fragilis* var. *furcata* Gaudin, a distinctive variety with bifurcate catkins, is abundantly naturalised at one location in South Gippsland (Carr 1996).

**Distribution and habitat:** *Salix fragilis* is thought to be native in southern Europe, and has been recorded throughout western Europe from Norway to Spain and Portugal (Meikle 1984). It is naturalised in Australia, New Zealand (Sykes 1988), China (Fang *et al.* 1999), North America (Argus 2007) and South America (Correa 1984). In New Zealand, it is widespread and abundant, and said to be the greatest nuisance of all willows (van Kraayenoord *et al.* 1995). In Australia, it is naturalised in South Australia, New South Wales, Victoria and Tasmania. In New South Wales, it is widespread and

abundant (Jacobs & Murray 2000). In Victoria, it has a scattered but locally common distribution mainly through the eastern part of the state and near Geelong and Werribee (Carr 1996). Most Victorian collections are male and almost all populations have arisen vegetatively (Carr 1996). In Tasmania, *Salix fragilis* var. *fragilis* is the most widespread and abundant naturalised willow. It was originally introduced for ornament and as a stream bank stabiliser for de-vegetated watercourses (Cremer *et al.* 1995). It has thrived and spread by human and natural means and today dominates the banks of many watercourses, where it causes many negative impacts (Fig. 3). Vegetative spread is by easily detached stems dispersed on water currents. It is particularly common in the Midlands, North-West and East Coast regions and is also known from the Furneaux, North-East and West Coast regions.

**First record:** 1944, W.M. Curtis.

**Selected specimens examined:** TASMANIA: Tin Kettle Island, part of Anderson Islands in Franklin Sound, 2.xii.1986, *S. Harris s.n.* (HO); South Arm, 26.ix.1996, *A.M. Buchanan 142B2* (HO); Bay River at Margate, 13.ii.1997, *A.M. Buchanan 14415* (HO); Collinsvale, 15.ii.2000, *A.M. Buchanan 15683* (HO); Birchs Bay, Dales Creek bridge on Channel Highway, 21.x.2003, *M.L. Baker 166* (HO, MEL); Sandy Bay Rivulet at Regent Street, Sandy Bay, 25.ii.2004, *M.L. Baker 3B2* (HO, MEL, herb. D. Meikle); Manning Rivulet at Churchill Avenue overpass, Sandy Bay, 25.ii.2004, *M.L. Baker 3B1* (HO, MEL, herb. D. Meikle); Brumbys Creek on B51, 3 km S of Cressy, 30.x.2003, *M.L. Baker 220* (HO); Cam River mouth, 31.x.2003, *M.L. Baker 241* (HO); Emu River, pumphouse area, Burnie, 31.x.2003, *M.L. Baker 247* (HO); Junction of Cam River and Maldon Creek, 31.x.2003, *M.L. Baker 240* (HO); West Tamar Highway and Atkinsons Road, 31.x.2003, *M.L. Baker 267* (HO); Frankford Road, Rubicon River, 31.x.2003, *M.L. Baker 266* (HO); Distillery Creek, Launceston, 1.xi.2003, *M.L. Baker 2B5* (HO). VICTORIA: Barwon River, Fyansford, c. 0.5 km below Buckley Falls, 2.xi.1997, *G.W. Carr 9711-161* (MEL, NSW, CANB); Banks of the Goulburn River at the end of Robert Street, Seymour, 8.xi.1997, *G.W. Carr 9711-182* (MEL, NSW, CANB).

## 2. *Salix alba* L. var. *vitellina* (L.) Stokes, Bot.

**Mat. Med. 4: 506 (1812)**

**Common name:** Golden Upright Willow

**Illustrations:** Fig. 1B; 2B

**Trees** to 15(–25) m tall. **Branches** erect to spreading, often semi-pendulous towards the tips and especially

in the lower crown, forming a rounded crown. *Bark* rough, coarsely fissured, grey-brown. *Stems* appressed pubescent, hairs persistent on leafy stems but sometimes only sparsely so, orange-yellow. *Bud scales* pubescent, becoming glabrous, concolorous with the stems. *Stipules* linear, caducous. *Leaves* lanceolate, 60–145 mm long, 13–30 mm wide, covered in a fine layer of persistent, appressed, silvery hairs; adaxial surface becoming glossy, sometimes remaining sparsely hairy, with hairs remaining on midrib and margins; abaxial surface glaucous, persistently hairy; margin glandular-serrulate; apex acute to acuminate; petiole up to 15 mm long with glands at the lamina junction. *Catkins* appearing with the leaves on leafy side-shoots. *Male catkins* not seen in Tasmania. *Female catkins* 60–75 mm long, up to 8 mm wide, spreading; peduncle up to 8 mm long; bracts lanceolate, up to 4 mm long, pale yellow, hairy, especially on proximal half, caducous; ovary up to 4 mm long, shortly pedicellate, pale green, glabrous. *Seed* not seen.

**Discussion:** For a comprehensive treatment of *S. alba* var. *vitellina*, see Meikle (1984). This taxon is often treated at different ranks, for example as the cultivar *S. alba* 'Vitellina', as the subsp. *S. alba* subsp. *vitellina* (L.) Arcang. or as a distinct species *S. vitellina* L. In Tasmania, only female *S. alba* var. *vitellina* plants are recorded. This taxon is distinguished from other Tasmanian willows by its large upright habit. It is often semi-pendulous towards the ends of the branches, and more so in the lower crown. Its stems are conspicuously orange-yellow, a character that is especially obvious in the autumn and winter months when the tree is without leaves.

*Salix alba* var. *vitellina* is thought to have hybridised with *S. fragilis* var. *fragilis* at various sites throughout Tasmania, producing plants of intermediate characters that are referable to *S. xrubens*. Hybrids have also been observed in New South Wales and Victoria, most likely with *S. xrubens* and *S. fragilis* var. *fragilis* (Cremer 1995; Carr 1996). A closely related taxon, *S. alba* var. *caerulea* (Sm.) Sm. has been cultivated in Tasmania and is said to have produced viable seed (N. Parker pers. comm. 2005). Timber from *S. alba* var. *caerulea* is used to make cricket bats. A male clone with a distinctive large pyramidal crown is known to be cultivated in Campbell Town and Launceston and possibly at other locations

in the state. The plant's identity is unknown, but its bright, orange-yellow stems suggest that it is a cultivar of *S. alba* var. *vitellina* or a hybrid with that taxon as one parent. Other varieties and cultivars are grown as ornamentals throughout the world and some may be cultivated in Tasmania.

**Distribution and habitat:** *Salix alba* var. *vitellina* is thought to be an ancient selection, originating from central and southern Europe (Skvortsov 1999). It has been cultivated in Europe, possibly since Roman times (Bean 1980) and is now widespread in cultivation or as a relict of cultivation (Skvortsov 1999; Jonsell 2000). It is widely cultivated in the temperate regions of Australia, often on the banks of watercourses, lakes and ponds, and as a specimen tree in large parks and gardens. Carr (1996) and Jacobs and Murray (2000) regard it as naturalised in South Australia, New South Wales, Victoria and Tasmania. On the mainland of Australia, naturalised populations have resulted mainly from vegetative reproduction, producing frequent small populations (Carr 1996). The relatively non-brittle stems have restricted its spread in this manner, as compared to the very brittle stems of *S. fragilis* var. *fragilis*. In Tasmania, *S. alba* var. *vitellina* is one of the most commonly cultivated willows. It is frequently grown as a specimen tree in parks and gardens and on the banks of watercourses and water bodies in rural and urban areas throughout the state. Although Australian authors (Carr 1996; Jacobs & Murray 2000) consider this taxon naturalised in Tasmania, my opinion is that it is not seen in naturalised populations, and that the vast majority of trees were deliberately planted. At one site several small plants were observed growing near a larger, seemingly planted individual (Geilston Bay, Baker 188, HO, MEL). The smaller plants may have arisen from vegetative spread. The greatest threat that this taxon poses is through the production of seed and the subsequent invasion of suitable habitats by seedling willows. This may happen in areas where it is sympatric with male willow trees such as *S. fragilis* var. *fragilis*.

**First record:** 1976, W.M. Curtis.

**Selected specimens examined:** TASMANIA: St Peters Pass (c. 5 km NE of Oatlands), 22.ix.1976, W.M. Curtis s.n. (HO); Lower Snug, Channel Hwy, grounds of Channel Historical Museum, 21.x.2003, M.L. Baker 163 (HO); Campbell Town, 30.x.2003, M.L. Baker 218 (HO); Riverside, Launceston, 1.xi.2003, M.L. Baker 2B1



(HO); Faggs Gully Creek, Geilston Bay, 17.ii.2004, *M.L. Baker* 377 (HO, MEL, herb. D. Meikle); Port Sorell, Port Sorell Road, 1.xii.2004, *M.L. Baker* 1189 & *M.F. Duretto* (HO); 16.4 km from Bridport on Waterhouse Road. Deep Water property, 11.i.2005, *M.L. Baker* 1310 & *A.M. Gray* (HO); Westerway, banks of Tyenna River, 16.ii.2005, *M.L. Baker* 1591, *A. Crane* & *L. Pope* (HO); Lake Tiberias, Mud Walls Road. 3 km S of Midland Highway, 31.x.2006, *M.L. Baker* 1734, *A.M. Buchanan* & *A.M. Gray* (HO). **VICTORIA:** Melbourne, suburb of Brunswick, c. 100 m N of end of Albion Street, 2.x.1994, *G.W. Carr s.n.* (MEL); Forest Creek, 5.x.2005, *M.L. Baker* 1639, *G. Carr* & *K. Stewart* (HO).

### 3. *Salix xrubens* Schrank, *Baier*. fl. 1: 226 (1789)

*Illustration:* Fig. 1C

*Trees* to 25 m tall. *Branches* spreading, forming a broad rounded crown. *Bark* rough, coarsely fissured, grey. *Stems* thinly pubescent, soon becoming glabrous, brown to olive-brown or orange-yellow to reddish. *Bud scales* sericeous, soon becoming glabrous, concolorous with the stems or darker. *Stipules* narrow linear, caducous. *Leaves* lanceolate to linear-lanceolate, 90–150(–200) mm long, up to 20 mm wide, sericeous, soon becoming glabrous; adaxial surface glossy to dull green; abaxial surface glaucous, sometimes with a fine layer of appressed hairs; margin glandular-serrate; apex acuminate; petiole up to 18 mm long, with several glands at the lamina junction. *Catkins* appearing with the leaves on leafy side-shoots. *Male catkins* 35–80 mm long, up to 13 mm wide, spreading to erect; peduncle up to 12 mm long; bracts oblong, up to 3 mm long, pale yellow, thinly pilose; glands 2, oblong, up to 1 mm long; stamens 2, exceeding bracts in length, pilose at base. *Female catkins* up to 80(–120) mm long, up to 8 mm wide, spreading, sub-erect to pendulous; bracts oblong, up to 4 mm long, pale yellow to yellow-green, variously hairy; ovary 2–4(–5) mm long, sub-sessile or shortly pedicellate, pale green, glabrous. *Seed* not seen.

**Discussion:** For a comprehensive treatment of *S. xrubens* see Meikle (1984). *S. xrubens* is a hybrid, the parents being *S. fragilis* and *S. alba*. In Tasmania, *S. xrubens* occurs as at least two different cultivated forms that are not known to be fully naturalised. These are *S. xrubens* nothovar. *basfordiana* (Scaling ex Salter) Meikle f. *basfordiana* Meikle and *S. xrubens* nothovar. *basfordiana* f. *sanguinea* Meikle. In addition to these cultivated plants, there is at least one occurrence of

*S. xrubens* that is the result of *in situ* hybridisation. Australian workers, as outlined in Table 1, regard this taxon to be naturalised in Tasmania. However, I believe that the name *S. xrubens* has, in part, been incorrectly applied to the widespread weedy taxon that is treated here as *S. fragilis* var. *fragilis* (see discussion under *S. fragilis* var. *fragilis*).

*Salix xrubens* may be confused with *S. alba* var. *vitellina* and *S. fragilis* var. *fragilis*. Both *S. xrubens* and *S. fragilis* var. *fragilis* have red rootlets in water. The leaves of *S. xrubens* usually retain some hairs whereas *S. fragilis* var. *fragilis* quickly becomes completely glabrous. *S. xrubens* is present as both sexes and one would expect to find mixed sex populations if they were formed from *in situ* hybridisation.

**Distribution and habitat:** *Salix xrubens* is common in central Europe as well as in western and temperate Russia and is often associated with non-native habitats (Skvortsov 1999). In New Zealand, *S. xrubens* is common where *S. alba* var. *vitellina* and *S. fragilis* grow together. The plants may be of either sex and backcrossing occurs (Sykes 1988).

In New South Wales, it is considered a very serious environmental weed, and is regenerating by seed (Jacobs & Murray 2000). In Victoria, it is a very widespread and common weed, along stream banks, particularly in the south of the state. In Tasmania, the cultivated forms of *S. xrubens* are uncommon. At Barretta, in the East Coast region a small population (*Baker* 159, HO) of *S. xrubens* nothovar. *basfordiana* f. *basfordiana* was recorded growing in a low lying wet area adjacent to a dam. All plants were female, suggesting the population had resulted from vegetative spread. Deliberate planting in this case could not be ruled out. *Salix xrubens* hybrids that have formed *in situ* are also not common in Tasmania. Young plants thought to be of this hybrid cross have been observed at Westerway, in the East Coast region of the state (*Baker* 1535, HO). *Salix xrubens* may be more widespread in Tasmania due to difficulties in distinguishing it from *S. alba* var. *vitellina* and *S. fragilis* var. *fragilis*.

*First record:* 2003, *M.L. Baker*.

**Selected specimens examined:** **TASMANIA:** Barretta, Kingborough Refuse Centre, 30.iv.2003, *M.L. Baker* 106 (HO, MEL); Faggs Gully Creek, Geilston Bay, 17.ii.2004, *M.L. Baker* 378 (HO, MEL, herb. D. Meikle); Westerway, banks of Tyenna

River, 16.ii.2005, M.L. Baker 1535, A. Crane & E. Pope (HO). **NEW SOUTH WALES:** Numeralla River, 11.x.1995, S.W.L. Jacobs 7882 (NSW, MEL); University of New England campus, Armidale, 6.x.1997, G.W. Carr 9710-56, J.R. Hosking, J.J. Bruhl & M. Gardener (NSW, CANB, MEL, NE).

**4. *Salix xpendulina* Wender. var. *pendulina*,  
Schriften Ges. Beförd. Gesamten Naturwiss.  
Marburg 2: 235 (1831)**

*Previously misapplied names:* *Salix babylonica* (Curtis 1967; Rodd 1982; Carr 1996; Jacobs & Murray 2000; Buchanan 2007).

**Common name:** Weeping Willow

**Illustrations:** Fig. 1C, 2C

*Trees* to 20 m tall with a wide crown and pendulous branches. *Bark* deeply and coarsely fissured, grey. *Stems* glabrous, olive-brown to grey-brown. *Bud scales* sparsely hairy at first, becoming glabrous, brown. *Stipules* mostly narrow-ovate, glandular-serrate with glands also present on the adaxial surface, caducous. *Leaves* lanceolate, up to 135 mm long, 15–22 mm wide, very sparsely hairy when young, soon becoming glabrous; adaxial surface glossy green; abaxial surface glaucous; margin coarsely glandular-serrate; apex acuminate; petiole up to 12 mm long, with glands near the lamina junction. *Catkins* appearing with the leaves on leafy side-shoots. *Male catkins* not seen in Tasmania. *Female catkins* 15–32 mm long, 5–8 mm wide, spreading to slightly descending or ascending; bracts oblong to narrowly ovate, 1–2 mm long, pale yellow to yellow-green, sparsely hairy on margin; ovary 2–3.5 mm long, shortly pedicellate, pale green, glabrous or very sparsely hairy at the base. *Seed* < 1 mm long.

**Discussion:** For a comprehensive treatment of *S. xpendulina* var. *pendulina*, see Meikle (1984). Only female plants have been recorded in Tasmania. Both male and female plants have been recorded in New South Wales and Victoria (Carr 1996; Jacobs & Murray 2000). *Salix xpendulina* is a hybrid, the parents being *S. fragilis* var. *fragilis* and *S. babylonica*. It has previously been referred to in Tasmania as *S. babylonica* (Curtis 1967; Rodd 1982; Carr 1996; Jacobs & Murray 2000; Buchanan 2007). However, the name *Salix babylonica* has been misapplied in Tasmania, and it would appear that all non-golden-stemmed weeping tree willows are *S. xpendulina* in this state. Carr (1996) claims that

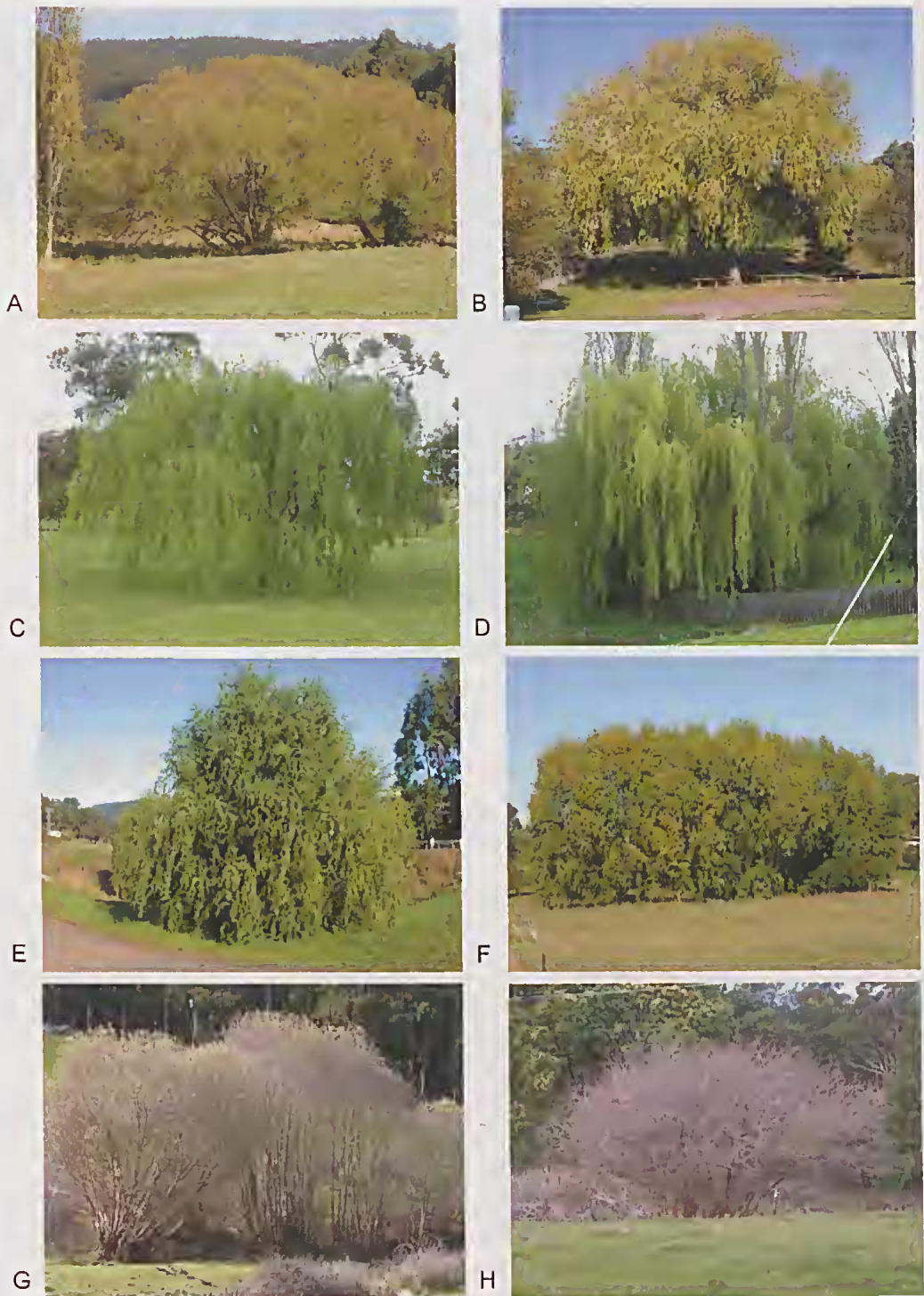
many of the Australian specimens of *S. babylonica* are referable to *S. xpendulina* and *S. xsepulcralis*. The concept of *S. xpendulina* var. *pendulina* accepted in this account is that of Meikle (1984). It is distinguished from the other, strongly-weeping tree willow, *S. xsepulcralis* nothovar. *chrysocoma*, by its stems being olive-brown as opposed to golden-yellow, and by having relatively short catkins composed of only female flowers. *Salix xpendulina* differs from *S. babylonica* by having distinctly pedunculate catkins that are usually greater than 20 mm long. One cultivated specimen with ovaries sparsely hairy at the base has been observed in Tasmania (Warrane, Baker 211, HO). These can be referred to as *S. xpendulina* var. *elegantissima* C.Koch (Meikle 1984). The type variety has completely glabrous ovaries.

**Distribution and habitat:** Although its origin is unclear, it is thought that *S. xpendulina* is a garden hybrid that originated in Germany early in the 1800s (Meikle 1984). In New Zealand, it is naturalised throughout the country, especially in moist places near still or flowing water (Sykes 1988 as *S. babylonica*). In New Zealand literature, it is treated within *S. babylonica*, as plants are described with catkins up to 30 mm long (New Zealand material not seen). In Victoria, it is widely cultivated for ornament, and naturalised populations grow along streams; it is unknown whether naturalised populations have arisen by vegetative means or by *in situ* hybridisation (Carr 1996). It is also naturalised in New South Wales. Curtis (1967) remarks that this species is commonly planted and is more or less naturalised in Tasmania. Whilst it is commonly cultivated as roadside plantings, in parks and large gardens, and on the banks of watercourses and other water bodies, it has not been recorded as a naturalised species. All individuals appear to have been planted deliberately and are not actively spreading. It has the potential to breed with plants of other male willow taxa.

**First record:** 1971, W.M. Curtis.

**Specimens examined:** **TASMANIA:** Hayes, 4.x.1971, W.M. Curtis s.n. (HO, BP); Three Hut Point, Gordon, 21.x.2003, M.L. Baker 167 (HO); Huonville, Apex Park, 21.x.2003, M.L. Baker 174 (HO); Southern Outlet, Kingston, 22.x.2003, M.L. Baker 181 (HO); Faggs Gully Creek, Gellston Bay, 27.x.2003, M.L. Baker 195 (HO, MEL, herb. D. Meikle); Kangaroo Bay Rivulet, between Rosny Golf Course and Warrane, 29.x.2003, M.L. Baker 213 (HO,





**Figure 2.** Habit of selected *Salix* taxa. **A)** *S. fragilis* var. *fragilis*; **B)** *S. alba* var. *vitellina*; **C)** *S. pendulina* var. *pendulina*; **D)** *S. xsepulcralis* nothovar. *chrysocoma*; **E)** *S. matsudana* 'Tortuosa'; **F)** *S. matsudana*  $\times$  *S. alba* (windbreak planting consisting of several trees); **G)** *S. xreichardtii*; **H)** *S. cinerea* subsp. *cinerea*.



**Figure 3.** *Salix fragilis* var. *fragilis* growing on the floodplains and banks of the South Esk River at Longford.

MEL, herb. D. Meikle); Deloraine Rotary caravan park at Mersey River, 30.x.2003, *M.L. Boker* 229 (HO); Campbell Town, Elizabeth River, 30.x.2003, *M.L. Baker* 217 (HO); Riverside, Launceston, 1.xi.2003, *M.L. Baker* 278 (HO). **NEW SOUTH WALES:** Bango Creek, Yass, 16.x.1980, *R. Coveny* 10758 & *P. Hind* (HO, NSW); Lachlan River, Cowra, 16.x.1980, *R. Coveny* 10744 & *P. Hind* (HO, NSW); Flood Creek, Braidwood, 21.x.1980, *R. Coveny* 10832 & *P. Hind* (HO, NSW). **VICTORIA:** Burrowye Creek (a tributary of Murray River), 5 km NW of Burrowye Post Office, 17.x.1980, *R.G. Coveny* 10784 & *P.D. Hind* (HO, NSW, MEL); 100 m SW of Leneva School, 18.x.1980, *R.G. Coveny* 10787 (HO, NSW, MEL); Castlemaine, Victoria, Forest Creek, 5.x.2005, *M.L. Boker* 1640, *G. Corr* & *K. Stewart* (HO).

**5. *Salix* ×*sepulcralis* Simonk. nothovar. *chrysocoma* (Dode) Meikle, *Watsonia* 15(3): 274 (1985)**

**Common name:** Golden Weeping Willow

**Illustrations:** Fig. 1E; 2D

*Trees* up to 15(–18) m tall with a wide-spreading crown and pendulous branches. *Bark* deeply fissured, grey to brown. *Stems* golden-yellow, sparsely pubescent, soon becoming glabrous. *Buds* golden to greenish-yellow, pubescent, soon becoming glabrous. *Stipules* small and caducous or absent. *Leaves* lanceolate, 45–110 mm long, up to 20 mm wide, thinly pilose, becoming glabrous, adaxial surface glossy, abaxial surface glaucous; margin irregularly glandular-serrate; apex acuminate; petiole up to 8 mm long, yellow, often with 1 or more glands near the lamina junction. *Catkins* appearing with leaves on short, leafy side shoots, comprised of either solely male flowers, solely female flowers or bisexual, up to 50 mm long, 5–10 mm wide, spreading to erect, commonly curved; bracts lanceolate, c. 2 mm long, yellow, sparsely pubescent. *Stamens* 2, exceeding bracts in length; filaments hairy

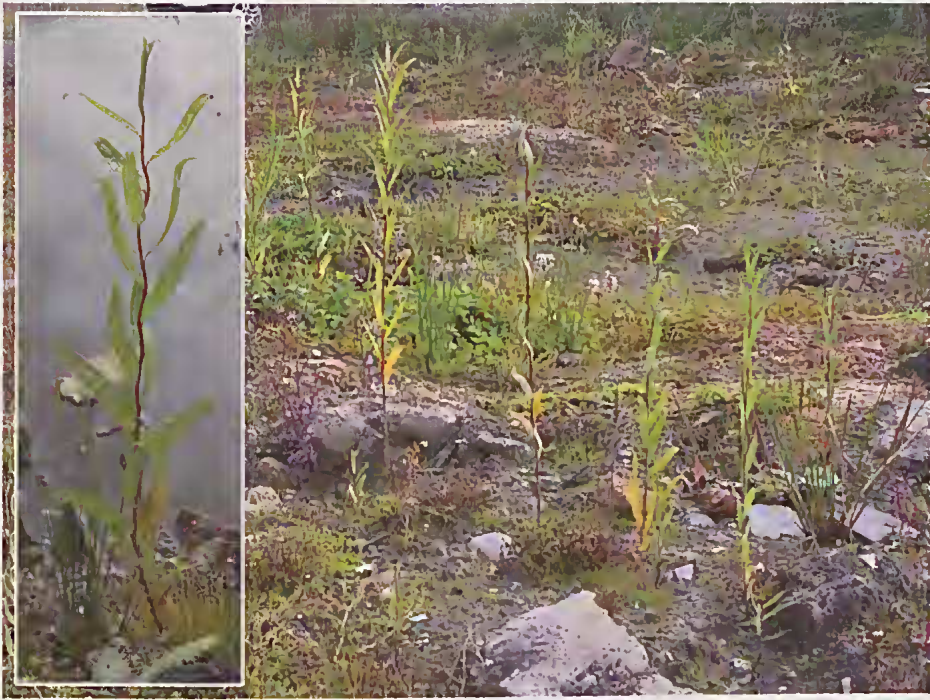
towards base. *Ovary* 2–3 mm long, green, glabrous, sessile to sub-sessile. *Seed* seen occasionally.

**Discussion:** For a comprehensive treatment of *S. xsepulcralis* nothovar. *chrysocoma*, see Meikle (1984). Plants are frequently bisexual, with male, female and bisexual catkins occurring on the same tree. The golden weeping willow is one of only two Tasmanian willows that have bisexual catkins (the other being one of the New Zealand-produced *S. matsudana* × *S. alba* clones). *Salix* ×*sepulcralis* nothovar. *chrysocoma* is a hybrid that combines the golden-yellow stems of *S. alba* var. *vitellina* with the strong weeping habit of *S. babylonica*, two characters that distinguish it from all other willows in Tasmania. *Salix alba* var. *vitellina* is somewhat weeping, but it is never as pendulous as *S. xsepulcralis* nothovar. *chrysocoma*. It is said to be far more commonly cultivated in Europe than the true *S. babylonica* (Akeroyd 1993), a taxon thought to be either extremely rare or no longer grown in the British Isles (Meikle 1984) and not recorded correctly in Tasmania.

The type variety (*S. xsepulcralis* var. *sepulcralis*), a less pendulous, olive-stemmed tree, is recorded for New South Wales (Carr 1996; Jacobs & Murray 2000) and Victoria.

**Distribution and habitat:** *Salix* ×*sepulcralis* nothovar. *chrysocoma* is a very commonly cultivated willow. Its origins are largely unknown, but it was first described from cultivated material grown in Europe (Meikle 1984). In New Zealand, it is widely planted in streambank habitats, grows wild with *S. fragilis* and *S. alba*, and is thought to hybridise with them (Sykes 1988, as *S. xchrysocoma*). In New South Wales, it is widely planted and commonly naturalised (Jacobs & Murray 2000). In Victoria, it is widely planted for ornament and stream stabilisation and is commonly naturalised. Seed is set but the tree typically reproduces by vegetative





**Figure 4.** Saplings of *S. matsudana* 'Tortuosa' × *S. fragilis* var. *fragilis* at a disturbed site in Huonville.  
Inset: Close-up of a single sapling showing contorted stem and leaves.

means (Carr 1996). In Tasmania, it is grown as roadside plantings, in parks and large gardens, and is often planted on the banks of watercourses and water bodies in rural areas. It is rarely recorded as naturalised, most plants appear to have been planted deliberately. At one location (Emu River, Burnie *Baker 248*, HO), a small degree of vegetative spread, limited to a few plants, is evident but deliberate planting still cannot be ruled out. This taxon is capable of sexual reproduction, a population of small saplings were growing in a roadside drainage line in southern Tasmania (Lucaston, *Baker 1745*, HO). The plants had characteristic yellow stems of *S. xsepulcralis* nothovar. *chrysocoma*. Both *S. fragilis* var. *fragilis* and *S. xsepulcralis* nothovar. *chrysocoma* were in cultivation nearby. *Salix xsepulcralis* nothovar. *chrysocoma* may have also been a parent of an infestation of plants which grew in sediment settling ponds at Launceston.

*First record:* 1969, W.M. Curtis.

**Selected specimens examined:** **TASMANIA:** Melton Mowbray, 27.ix.1969, W.M. Curtis s.n. (HO); Huonville, Apex Park, 21.x.2003, M.L. Baker 172 (HO); Kingston, along Southern

Outlet, 22.x.2003, M.L. Baker 180 (HO); Kangaroo Bay Rivulet, between Rosny Golf Course and Warrane, 29.x.2003, M.L. Baker 212 (HO); Campbell Town, Elizabeth River, 30.x.2003, M.L. Baker 216 (HO); Burnie, Emu River, pumphouse area, 31.x.2003, M.L. Baker 24B (HO); Penguin, Penguin Creek, 31.x.2003, M.L. Baker 251 (HO); Launceston, Riverside, 1.xi.2003, M.L. Baker 271 (HO); Perth (South Esk River), park area near bridge, 1.xi.2003, M.L. Baker 288 (HO); 4.9 km W of Bridport on the Bridport/George Town road, 12.i.2005, M.L. Baker 1420 & A.M. Gray (HO). **VICTORIA:** Melbourne, suburb of Macleod, Borlase Reserve, junction of Lower Plenty Road and Greensborough Road, 29.x.1994, G.W. Carr s.n. (MEL).

## 6. *Salix matsudana* Koidz. 'Tortuosa'

**Common names:** Tortured Willow, Twisted Willow

**Illustrations:** Fig. 1F; 2E

Trees 10–15 m tall. Branches strongly contorted, forming a rounded crown. Bark fissured, grey. Stems contorted, slightly pendulous, at first thinly pubescent, soon becoming glabrous, green to dark reddish. Bud scales pubescent, soon becoming glabrous. Stipules mostly linear, contorted, caducous. Leaves lanceolate, 80–130 mm long, 10–25 mm wide, at first pubescent,

soon becoming glabrous or very sparsely hairy, contorted; adaxial surface deep green and lustrous; abaxial surface glaucous; margin glandular-serrulate; apex acuminate; petiole up to 5 mm long without glands. *Catkins* appearing with the leaves. *Male catkins* unknown. *Female catkins* 10–15(–20) mm long, up to 5 mm wide, spreading, curved; peduncle 2–4 mm long; bracts oblong, up to 1.5–2.5 mm long, pale yellow, sparsely hairy; ovary 2–2.5 mm long, sessile, glabrous. *Seed* not seen.

**Discussion:** For other treatments of *S. matsudana* 'Tortuosa', see Carr (1996) and Jacobs and Murray (2000). In Australia, it is known only as a female plant and bears very short and narrow catkins. *Salix matsudana* 'Tortuosa' can be immediately distinguished from other willows that grow in Tasmania by its strongly contorted branches, stems and leaves. Some authors believe that the species is synonymous with *S. babylonica* (Skvortsov 1999; Jonsell 2000). For consistency with other Australian workers (Carr 1996; Jacobs & Murray 2000), the name *Salix matsudana* 'Tortuosa' has been adopted. This plant is capable of producing viable seed and seedlings through hybridisation with plants of other willow taxa. For example, a small infestation of plants was recorded at Huonville (Baker 1711, HO), ranging in size from 3–50 cm tall, growing in a poorly drained, disturbed site of approximately 100 square metres in extent. The plants appeared to have arisen from seed because hand-pulled plants had well-developed tap roots. The plants displayed varying degrees of contortedness, indicating that *S. matsudana* 'Tortuosa' is one of the parents (Fig. 4). The second parent (pollen donor) was most likely *S. fragilis* var. *fragilis*. Both *S. matsudana* 'Tortuosa' and *S. fragilis* var. *fragilis* were growing together in a nearby garden. Such hybrid plants may be more common in Tasmania. Hybrids of this nature have been recorded at Kyneton, Victoria (Baker 1637, HO) and New Zealand (Sykes 1988).

**Distribution and habitat:** The tortured willow was introduced as an ornamental plant from China to Europe in the early 1920s (Bean 1980). It is naturalised in New South Wales (Jacobs & Murray 2000) and in Victoria, where it is widely cultivated and has become sparingly naturalised by vegetative means (Carr 1996). Field observations indicate that whilst this

taxon is commonly cultivated throughout Tasmania, it is hardly naturalised. Occasionally individuals or small groups of trees grow around municipal rubbish tips from dumped garden refuse (for example at Rosebery and Queenstown). However, it is never seen in large populations, nor is it seen infesting banks of waterways.

*First record:* 2003, M.L. Baker.

**Selected specimens examined:** TASMANIA: Rosny Golf Course, 30.iv.2003, M.L. Baker 104 (HO); Huon Highway, W of Sandfly junction, 12.ix.2003, A.M. Gray 1275 (HO); Kingston, Southern Outlet, 22.x.2003, M.L. Baker 179 (HO); Deloraine Rotary Caravan Park, Deloraine, 30.x.2003, M.L. Baker 230 (HO); Perth (South Esk), park area near bridge, 1.xi.2003, M.L. Baker 287 (HO); Royal Tasmanian Botanical Gardens, 4.iii.2004, M.L. Baker 390 & N. Papworth (HO); Rosebery, waste transfer station, 15.ix.2004, M.L. Baker 568 & A.M. Gray (HO); Pioneer, 11.i.2005, M.L. Baker 1363 & A.M. Gray (HO). VICTORIA: Ballarat/Sebastopol, c. 250 m downstream from Prest Street bridge crossing of the Yarrowee River, 19.x.1994, V. Stajcs 1018 (MEL, NSW, AD); Kyneton, Johnson Court, Post Office Creek, 5.x.2005, M.L. Baker 1636, G. Carr & K. Stewart (HO).

### 7. *Salix matsudana* Koidz. × *Salix alba* L.

**Common names:** New Zealand Hybrid Willow, Matsudana Hybrid Willow

**Illustrations:** Fig. 1G; 2F

*Trees* to 25 m tall. *Branches* upright, forming a narrow-conical crown, sometimes semi-pendulous, especially in lower crown. *Bark* fissured, grey. *Stems* pubescent, soon becoming glabrous, grey-green to reddish brown, moderately brittle. *Bud scales* sericeous, soon becoming glabrous, brown. *Stipules* lanceolate, glandular serrate, caducous. *Leaves* lanceolate, 90–140 mm long, 10–17 mm wide, sericeous, soon becoming glabrous; adaxial surface glossy green, abaxial surface glaucous; margin glandular-serrulate, occasionally entire; apex acute to acuminate; petiole up to 10 mm long, without glands at the lamina junction. *Catkins* appearing with the leaves on leafy side-shoots, composed of either solely male flowers, solely female flowers or mixed male and female flowers. *Male catkins* up to 35 mm long, 7–9 mm wide, spreading to erect; bracts, lanceolate, up to 2.5 mm long, pale yellow, sparsely hairy at the base; stamens 2, exceeding the bracts, pilose near the base. *Female catkins* 15–30 mm long, 5–9 mm wide,



spreading to erect; bracts ovate or lanceolate, 1.5–2 mm long, pale yellow, glabrous or sparsely hairy at the base; ovary shortly pedicellate, pale green, glabrous. *Bisexual catkins* ranging from either predominantly male through to predominantly female, 30–50 mm long; floral characters similar to those of male and female flowers. *Seed* c. 1 mm long.

**Discussion:** This description includes characters from several different clones that were developed in New Zealand by breeding non-tortuose *S. matsudana* with *S. alba*. There are at least three different clones in Tasmania, with at least one being female, one male and a bisexual clone named *S. matsudana* × *S. alba* 'Cannock'. The *S. matsudana* × *S. alba* clones were developed to produce willows suitable for soil conservation and river bank protection. Plants were selected for traits such as rapid establishment, resistance to diseases, extensive root development, narrow crown form and adaptability to extreme site conditions. Three clones were released in 1975 with a further six in 1980 (van Kraayenoord *et al.* 1995). The clones are: 'Cannock' (bisexual), 'Makara' (female), 'Te Awa' (female), 'Tangoio' (female), 'Hiwinui' (male), 'Adair' (male), 'Wairakei' (male), 'Moutere' (male) and 'Aokautere' (male) (Wilkinson *et al.* undated).

This group of willows can be distinguished from other Tasmanian willows by their narrow upright crowns, usually consisting of a single main stem, a character especially obvious in younger specimens. The twigs are olive-green in colour. The branches are often semi-pendant, especially in the lower crown.

**Distribution and habitat:** These willows are widely planted throughout south-eastern Australia and have started to spread by seed in some rivers in New South Wales and the Australian Capital Territory (Cremer 1995; Carr 1996; Jacobs & Murray 2000). One of the clones has become naturalised by vegetative means in Victoria (Carr 1996). In Tasmania, they are commonly grown in rural areas as windbreak/fence-line plantings and less often as specimen trees for ornament but no plants are known to be naturalised in this state. However, apparently viable seed has been observed in the fruit of the bisexual clone (N.Parker pers. comm. 2005). Planting female specimens is discouraged (Anon. 2007) and the male clones are said to readily hybridise with *S. babylonica*, *S. matsudana* and *S. alba* (Cremer 1995; Jacobs & Murray 2000; Cremer 2003).

*First record:* 2002, N. Parker.

**Selected specimens examined:** **TASMANIA:** 'Leighton' near Western Junction, 31.x.2002, N. Parker s.n. (HO); Channel Highway, Margate, fence-line planting opposite Kingborough Bowls Club, 21.x.2003, M.L. Baker 15B (HO, MEL, CANB); Huon Highway and Collara Road junction, 22.x.2003, M.L. Baker 1B2 (HO); Lucaston, Bakers Creek Road, 22.x.2003, M.L. Baker 1B4 (HO); Elphinstone Road (C516), 30.x.2003, M.L. Baker 222 & 223 (HO); Mooreville Road and Mount Road junction near Ridgley, 30.x.2003, M.L. Baker 237 (HO); Tasmanian Arboretum, 30.x.2003, M.L. Baker 232 (HO); West Tamar Highway, 31.x.2003, M.L. Baker 26B (HO); Junction of Forth River and Bass Highway, 31.x.2003, M.L. Baker 262 (HO). **NEW SOUTH WALES:** Gardners Road, Orange, 9.x.1995, S.W.L. Jacobs 7B39 (NSW, MEL); Agricultural Research Station, Orange, 9.x.1995, S.W.L. Jacobs 7B32 (NSW, CANB, MEL). **VICTORIA:** Forest Creek, Castlemaine, 5.x.2005, M.L. Baker 1641, G. Carr, & K. Stewart (HO); Harcourt, Barkers Creek, 5.x.2005, M.L. Baker 163B, G. Carr & K. Stewart (HO).

## 8. *Salix xreichardtii* A.Kern., *Verh. K. K. Zool.-Bot. Ges. Wien* 10: 249 (1860)

*Previously misapplied names:* *S. atrocinerea* Brot. (Curtis 1967), *S. cinerea* (Rodd 1982; Carr 1996; Jacobs & Murray 2000; Buchanan 2007).

*Common name:* Pussy Willow

*Illustrations:* Fig. 1H, 2G

Multi-stemmed *shrubs* or small *trees* up to 12(–16) m tall. *Branches* erect, forming a crown that is usually taller than wide. *Bark* usually smooth, developing longitudinal fissures with age. *Stems* densely pubescent when young but becoming glabrous with age, grey when hairy but becoming reddish brown, olive or grey with age. *Bud scales* densely pubescent at first, soon glabrous, concolorous with stems, often reddish. *Stipules* auriculate, up to 5 mm long, irregularly serrate, caducous; serrations gland-tipped. *Leaves* mostly elliptic, sometimes obovate or oblong, 50–120 mm long, 25–55 mm wide; adaxial surface densely pubescent when young, becoming glabrous to sparsely hairy; abaxial surface dull green to glaucous, with hairs persistent; margin revolute, strongly and irregularly undulate-serrate, with teeth usually gland-tipped; apex acute, often twisted obliquely; petiole 6–10(–14) mm long. *Catkins* appearing before the leaves. *Male catkins* 20–30(–50) mm long, 10–20 mm wide, erect; bracts broadly lanceolate to rhomboid, up to 3 mm long, black in upper 1/2–2/3, sericeous; stamens

2, greatly exceeding the bracts. *Female catkins* not seen in Tasmania.

**Discussion:** For a discussion of *S. ×reichardtii* see Meikle (1984). *Salix ×reichardtii* is a hybrid, the parents being *S. cinerea* and *S. caprea*. It is unlikely that *S. ×reichardtii* appeared in Tasmania as the result of *in situ* hybridisation, and instead, a selection (or selections) would have been introduced into the state. This hybrid is not treated in Curtis (1967). However, I believe that the name *S. atrocinerea*, which is treated by Curtis (1967), was misapplied to *S. ×reichardtii*. *Salix atrocinerea* is a synonym of *S. cinerea* subsp. *oleifolia*, and whilst it may have been present in Tasmania at the time of Curtis's publication, it certainly was not represented by any specimens in the Tasmanian Herbarium. Unidentified specimens of *S. ×reichardtii* were, however, in the collection at that time. Rodd (1982) cites in his treatment of *S. cinerea* a Tasmanian specimen (Huon Road, near Longley, *Curtis s.n.*, HO) that is here referred to *S. ×reichardtii*. Subsequent Australian authors (Carr 1996; Jacobs & Murray 2000; Buchanan 2007), in my opinion, have misapplied the name *S. cinerea* to Tasmania on the basis of the above references.

Material upon which the above description is based was sent to British *Salix* specialist Desmond Meikle for his comment, and although he could find *affinities* with *S. cinerea*, *S. caprea* L. and *S. ×reichardtii*, he was 'regrettably puzzled' by the specimens (D. Meikle *in litt.*). In this treatment, the plant is referred to as *S. ×reichardtii*, and conforms to the descriptions and naming of similar material that occurs in New South Wales, Victoria and New Zealand (New Zealand material not seen).

*Salix ×reichardtii* can be difficult to distinguish from the other naturalised shrub willows in Tasmania. Its narrow and upright habit, in contrast to the rounded habit of *S. cinerea*, is usually a reliable field character. The leaves of *S. ×reichardtii* are commonly elliptic as opposed to obovate in *S. cinerea*. The margins of *S. ×reichardtii* leaves are markedly more irregular and undulate than those of *S. ×calodendron*. The rust-coloured indumentum on the leaves of *S. cinerea* subsp. *oleifolia* is not present on *S. ×reichardtii* leaves. Also, *S. ×reichardtii* is only known from male plants; female populations would indicate *S. ×calodendron* and mixed-sex populations would be the sexually-reproducing *S. cinerea* or perhaps a backcross between

*S. cinerea* and *S. ×reichardtii*. The wood under peeled bark of *S. ×reichardtii*, *S. cinerea* and *S. ×calodendron* is variously ridged, and is a good spotting character for all of these taxa.

A complex series of hybrids between *S. ×reichardtii* and *S. cinerea* subsp. *cinerea* has been noted in one location in Victoria (Carr 1996). It is possible that this has also occurred in Tasmania, but this is supported only by anecdotal evidence. An ornamental weeping willow, marketed as *S. caprea* 'Weeping Sally', is occasionally cultivated in Tasmania. The pendulous scion, although reported to be *S. caprea*, has rust coloured indumentum on the leaves, indicating it has *S. cinerea* subsp. *oleifolia* parentage. It may be a hybrid between *S. caprea* and *S. cinerea* subsp. *oleifolia*, or a pendulous/prostrate form of the latter. It is female. The rootstock is *S. ×reichardtii*, in the sense described above. It is strongly upright and serves as robust stem to which the weeping scion is grafted. The rootstock is prone to shooting from the base, resulting in the production of flowering stems that are male. The flowering time of the scion and rootstock overlap, are in very close proximity and sexual reproduction results in the production of fertile seed.

**Distribution and habitat:** *Salix ×reichardtii* is native throughout Europe where both of its parents co-occur. In Australia, it is commonly planted as an ornamental and for shelter belts in New South Wales, Victoria and Tasmania, and is naturalised throughout this area on the banks of watercourses, lake shores and in drainage lines (Carr 1996; Cremer 1995; Jacobs & Murray 2000). In Tasmania, *S. ×reichardtii* is widely cultivated as an ornamental species in parks and large gardens, and is commonly planted in rural areas as a windbreak species. It is occasionally naturalised in drainage lines in paddocks and roadsides and along watercourses. Dispersal in these situations is by re-sprouting fallen trees and branches, although it is sometimes difficult to determine whether spread has been by natural means or if it has been facilitated by planting. It may serve as a pollen donor if in close proximity to female plants of *S. cinerea*.

*First record:* 1962, W.M. Curtis.

**Selected specimens examined:** TASMANIA: Huon Road, near Longley (c. 18 km S of Hobart), ix.1962, W.M. Curtis *s.n.* (HO); Harold Gatty Memorial Park, Campbell Town, 30.x.2003,



*M.L. Baker 219* (HO); Ulverstone, Bass Highway/Preston Road junction, 31.x.2003, *M.L. Baker 259* (HO); Riverside, Launceston, 1.xi.2003, *M.L. Baker 270* (HO); She Oak Road, 7.iv.2004, *M.L. Baker 409* (HO); Williamsford, 17.iv.2004, *L.H. Cave 282* (HO); Fourteen Mile Road, (C601) c. 1 km from Lyell Hwy., 5.v.2004, *A.M. Gray 1359* (HO); 16.4 km from Bridport on Waterhouse Road, Deep Water property, 11.i.2005, *M.L. Baker 1311* & *A.M. Gray* (HO); George Town waste transfer station (tip) off Mt George Road, 12.i.2005, *M.L. Baker 1466* & *A.M. Gray* (HO). **NEW SOUTH WALES:** 3 km E of Murrumbateman, 13.xii.1989, *B.J. Lepschi 242* (CANB).

### 9. *Salix cinerea* L., *Sp. pl.* 2: 1021 (1753) subsp. *cinerea*

**Common name:** Grey Sallow

**Illustration:** Fig. 1H; 2H

Multi-stemmed *shrubs* or small *trees* up to 5(–15) m tall. *Branches* erect to spreading, usually forming a rounded crown. *Bark* usually smooth, occasionally with longitudinal fissures. *Stems* densely pubescent when young, grey but soon becoming glabrous and reddish to orange-brown. *Bud scales* densely pubescent at first, soon glabrous, ±concolorous with stems. *Stipules* auriculate, up to 5 mm long, irregularly serrate, caducous; serrations gland-tipped. *Leaves* usually obovate, occasionally elliptic, 20–75 mm long, 10–35 mm wide, with indumentum of translucent uncoloured hairs; adaxial surface densely pubescent when young, becoming glabrous; abaxial surface densely pubescent when young, becoming glabrescent, usually retaining a sparse covering of scattered hairs, dull green; margin finely revolute, slightly to markedly irregularly undulate-serrate, with teeth usually gland-tipped; apex sub-acute, often twisted obliquely; petiole up to 10 mm long. *Catkins* appearing before the leaves. *Male catkins* 16–36 mm long, 18–24 mm wide, erect; bracts obovate, c. 2 mm long, black in upper 2/3, covered in long silvery hairs; stamens 2, greatly exceeding the bracts. *Female catkins* 20–50(–65) mm long, up to 16 mm wide, erect; peduncle up to 5 mm long; bracts obovate, c. 2 mm long, black in upper 1/2 to 1/3, covered in long, silvery hairs; ovary up to 9 mm long, pedicellate, pale green with a covering of silvery hairs. *Seed* c. 1 mm long.

**Discussion:** For a comprehensive treatment of *S. cinerea* subsp. *cinerea*, see Meikle (1984). The above description conforms with the application of this name in Victoria (Carr 1996). The misapplication of

the name *S. cinerea* to *S. ×reichardtii* in Tasmania is discussed under the treatment of *S. ×reichardtii*. *Salix cinerea* subsp. *cinerea* can be difficult to distinguish from the other naturalised shrub willows in Tasmania. Its rounded habit, in contrast to the more narrow and upright habit of *S. ×reichardtii*, is usually a reliable field character. However, the crown shape of *S. cinerea* subsp. *cinerea* varies from rounded when in open situations to more upright when growing in denser infestations or amongst closed vegetation. The leaves of *S. cinerea* are mostly obovate as opposed to the mainly elliptic leaves of *S. ×reichardtii* and *S. ×calodendron*. *Salix cinerea* subsp. *cinerea* differs from *S. cinerea* subsp. *oleifolia* by lacking rust-coloured indumentum on its leaves. *Salix cinerea* grows in mixed sex populations; populations of only male plants may indicate vegetative reproducing *S. ×reichardtii*. As with *S. ×reichardtii* and *S. ×calodendron*, the wood under peeled bark of, *S. cinerea* is variously ridged, and is a common spotting character for all of these taxa. The female catkins, ovaries and peduncle of *S. cinerea* subsp. *cinerea* lengthen significantly as they mature (catkins lengthen up to 85 mm long). The lengthening is not as prominent in *S. cinerea* subsp. *oleifolia*.

**Distribution and habitat:** *Salix cinerea* subsp. *cinerea* is native throughout Europe and temperate Asia (Meikle 1984, 1990) where it is one of a few willows that readily invades disturbed habitats such as ditches, forest edges and openings (Skvortsov 1999). It is naturalised in New Zealand (Sykes 1988) and Australia. In New Zealand, it is a widespread weed of wet habitats and is often the dominant species in swamps (Sykes 1988). In Australia, it is naturalised in South Australia, New South Wales, Victoria and Tasmania (Carr 1996; Jacobs & Murray 2000), along the banks of waterways and in seasonally or permanently wet areas such as drainage lines, lake and dam shores, and swamps and bogs.

Naturalised populations are known to be in Tasmania and on the mainland as mixed-sex populations. The main method of regeneration and spread of *S. cinerea* subsp. *cinerea* is via the production of wind and water borne seed. In Tasmania, the species is only known from two locations: in and around Queenstown in the West Coast region and from the Longley-Kingston area, south of Hobart, in the East Coast region. Two plants

have also been recorded growing in Hobart. In these areas, it is abundantly naturalised and widespread, and is the target of an eradication program. Naturalised populations require sufficiently moist habitats at the time the seed is released to successfully establish, and are consequently restricted to moist roadside cuttings, drainage lines, banks of watercourses and dams, and other permanently or seasonally wet areas. In some areas it has become the dominant species infesting large stretches of stream banks.

*First record:* 1999, A.J. North.

**Selected specimens examined:** **TASMANIA:** Lynchford, 23.ii.1999, A.J. North *s.n.* (HO); Southern Outlet A6, just east of North West Bay River, iv. 2000, A.M. Gray 1044 (HO); Electrona, corner of Channel Highway and Pothana Place, 26.ix.2002, A. Crane *s.n.* (HO); Huntingfield, Nautilus Grove, 24.ix.2003, M.L. Baker 152 (HO, MEL, NSW, CANB, AD, herb. D. Meikle); Sandfly, Southern Outlet, 26.ix.2003, M.L. Baker 156 (HO, MEL, CANB, AD, herb. D. Meikle); Southern Outlet, Kingston, 100 m N of Leslie Road underpass, 7.iv.2004, M.L. Baker 410 (HO, herb. D. Meikle); Longley/Sandfly junction 7.iv.2004, M.L. Baker 406 (HO, herb. D. Meikle); South Queenstown, 50 m E of bridge leading to cemetery, 14.ix.2004, M.L. Baker 499 & A.M. Gray (HO); Queenstown, entrance to old tip, Lynchford Road, 16.iv.2004, M.L. Baker 667 & A.M. Gray (HO); Lynchford, near Huon Pine timber yard, 16.iv.2004, M.L. Baker 668 & A.M. Gray (HO); Queenstown, tramline near cemetery, 18.ii.2005, M.L. Baker 1536, J. Robin & A. Laird (HO); Abelia Drive, off Millhouses Road, Longley (25 m NE), 7.xi.2006, A.M. Gray 1731 (HO). **NEW SOUTH WALES:** Botany Wetlands, Bonnie Doon Golf Course, 31.viii.1995, S.W.L. Jacobs 7B25 (NSW, MEL). **VICTORIA:** Macedon, Nursery Road at railway underpass, 5.x.2005, M.L. Baker 1633, G. Carr & K. Stewart (HO); Castlemaine, Forest Creek, 5.x.2005, M.L. Baker 1642, G. Carr & K. Stewart (HO).

## 10. *Salix cinerea* L. subsp. *oleifolia* (Sm.)

Macreight, *Man. Brit. bot.* 212 (1837)

*Common name:* Rusty Sallow

*Illustration:* Fig. 1J

Characters same as *S. cinerea* subsp. *cinerea* but leaves with an indumentum of translucent, uncoloured hairs and rust-coloured hairs, the latter sometimes only few and scattered. *Catkins* generally smaller in overall dimensions; male catkins 17–20 mm long; female catkins up to 35 mm long. *Seed* up to 2 mm long.

**Discussion:** For a comprehensive treatment of *S. cinerea* subsp. *oleifolia*, see Meikle (1984). The

misapplication of the name *S. atrocinerata* to *S. xreichardtii* in Tasmania is discussed under the treatment of *S. xreichardtii*. Both male and female plants are recorded in Tasmania. The presence of rust-coloured hairs on the leaf lamina allows this taxon to be differentiated from other willows that grow in Tasmania. The female catkins do not lengthen as significantly as they mature as they do in *S. cinerea* subsp. *cinerea*.

**Distribution and habitat:** *Salix cinerea* subsp. *oleifolia* is native to Europe where it occurs in Britain, Ireland, western France, Spain and Portugal (Meikle 1984). This subspecies is recognised as naturalised in Victoria (Carr 1996; Walsh & Stajsic 2007) where it grows in similar habitats to the type subspecies (Carr 1996). In Tasmania, it is confined to the North-West region. There is a large naturalised population, the target of an eradication program, between Penguin and Ulverstone, occupying similar habitats to those of *S. cinerea* subsp. *cinerea*. It has also been recorded on the banks of the River Leven near Gunns Plains, and near the township of Edith Creek. It is likely to be more widespread than records suggest.

*First record:* 2003, M.L. Baker.

**Selected specimens examined:** **TASMANIA:** Bass Highway between Penguin and Ulverstone, 31.x.2003, M.L. Baker 252 (HO); Bannons Park, Gunns Plains Road at River Leven, 1.xi.2004, M.L. Baker B1B & M.F. Duretto (HO, MEL, AD, CANB); C219 between Edith Creek (town) and Nabageena, E side of road, 2.xi.2004, M.L. Baker 1029 & M.F. Duretto (HO); Junction of South Road and Allens Road, between Penguin and Ulverstone, 3.xi.2004, M.L. Baker 1093 & M.F. Duretto (HO). **NEW SOUTH WALES:** Mannus Creek, 6.8 km SW of Tumbaramba, on road to Jingellic, 17.x.1980, R. Coveny 107B2 & P. Hind (CANB, NSW). **VICTORIA:** Morses Creek, Wandiligong, 13.x.1995, S.W.L. Jacobs 7901 (MEL, NSW).

## 11. *Salix xcalodendron* Wimm., *Salic. eur.* 187 (1866)

*Illustration:* Fig. 1K.

Multi-stemmed *shrubs* or *trees*, 12–15 m tall. *Branches* erect to spreading, forming a narrow or rounded crown. *Bark* rough, with scattered longitudinal fissures, grey. *Stems* densely pilose, silky to touch, ash-coloured; wood under peeled bark prominently ridged. *Bud scales* densely pubescent, gray-brown. *Stipules* auriculate, large and prominent, especially on new growth,



8–15 mm long, 5–7 mm wide. *Leaves* elliptic to obovate, up to 140 mm long and up to 50 mm wide, pubescent; adaxial surface glossy at first, becoming dull, with a thin covering of persistent hairs; abaxial surface grey, with a dense covering of persistent hairs; margin irregular, indistinctly glandular-serrate; apex acute; petiole stout, up to 10–15 mm long, densely pubescent. *Catkins* appearing before the leaves. *Male catkins* not known. *Female catkins* 35–75 mm long, 8–10 mm wide, erect to sub-erect, sub-sessile to shortly stalked; bracts ovate-rhomboid, up to 2.5 mm long, black in distal 2/3, pilose; ovary up to 3 mm long, shortly pedicellate, densely white-pubescent. *Seed* not produced.

**Discussion:** For a comprehensive treatment of *S. xcalodendron*, see Meikle (1984). *Salix xcalodendron* is thought to be a tri-hybrid willow, the parents being *S. caprea*, *S. cinerea* and *S. viminalis* L. It is most likely that it was introduced into Tasmania as a horticultural selection. *Salix xcalodendron* can be difficult to distinguish from the other naturalised shrub willows that occur in Tasmania. The leaves of *S. xcalodendron* and *S. xreichardtii* are commonly elliptic as opposed to obovate in *S. cinerea*. The margins of *S. xcalodendron* leaves are not as markedly irregular and undulate as are those of *S. xreichardtii*. *Salix xcalodendron* only occurs as female plants; wholly male populations would indicate *S. xreichardtii* and mixed-sex populations would be a sign of the sexually-reproducing *S. cinerea*. The wood under peeled bark of *S. xcalodendron*, *S. cinerea* and *S. xreichardtii* is variously ridged, and is a good spotting character for all of these taxa.

**Distribution and habitat:** *Salix xcalodendron* is presumed to be native to the British Isles where it has a scattered distribution. It is cultivated elsewhere in Europe and occasionally escapes from plantings (Akeroyd 1993). In New Zealand, it is widely cultivated and naturalised along the banks of streams and in swamps near original plantings (Sykes 1988). In Australia, it is occasionally grown for ornament and for stabilisation of stream banks in the south-eastern states. It is considered naturalised but uncommon in New South Wales (Jacobs & Murray 2000) and is possibly naturalised in Victoria (Carr 1996). In Tasmania, this willow is known from only two isolated locations. It was first recorded at Longley (Baker 1771, HO), in the East Coast region, where several large shrubs/

small trees are in cultivation in a permanently wet area, presumably to 'soak' up excess moisture. No obvious active regeneration by vegetative means was observed at this location. The second population grows on derelict land adjacent to the Queen River at Queenstown (Baker 1728, HO), in the West Coast region. The plants are confined to a small area and appear to have been planted, perhaps with some minor spread via vegetative means. It is considered to be sterile (Meikle 1984) and should not pose a weed threat through the production of seed.

*First record:* 2006, M.L. Baker.

**Specimens examined:** TASMANIA: Queenstown, bank of Queen River, 13.ix.2006, M.L. Baker 1728 (HO); Coombes Road, Longley, 22.xi.2006, M.L. Baker 1771 & A. Crane (HO, herb. D. Meikle). NEW SOUTH WALES: East Jindabyne, 12.x.1995, S.W.L. Jacobs 7887 (NSW).

## 12. *Salix purpurea* L., *Sp.pl.* 2: 1017 (1753)

*Common name:* Purple Osier

*Illustration:* Fig. 1L

Multi-stemmed *shrubs* to 6(–8) m tall. *Branches* spreading to erect, forming a rounded bush. *Bark* smooth, pale grey. *Stems* glabrous, whitish-grey. *Bud scales* glabrous, dark purple-brown. *Stipules* small, caducous or absent (not seen in Tasmanian material). *Leaves* linear, linear-lanceolate or oblanceolate, 25–85(–100) mm long, 5–30 mm wide, pubescent when young, soon becoming glabrous; adaxial surface green, sub-lustrous; abaxial surface somewhat paler than adaxial surface; mid-rib prominent, yellow; margin entire to sparsely minutely toothed; apex acute; petiole up to 7 mm long but usually quite short, without glands at the lamina junction. *Catkins* appearing before the leaves. *Male catkins* not seen in Tasmania but with similar general proportions to female catkins (see Meikle 1984); stamens 2, filaments and anthers joined, exceeding bracts in length. *Female catkins* 10–20(–30) mm long, 3–4(–7) mm wide, erect to sub-erect, curved; peduncle 2–3 mm long; bracts ovate, up to 1 mm long, dark brown to black, pilose; ovary 1–1.5(–3) mm long, sessile with a dense covering of short, whitish hairs. *Seed* not seen.

**Discussion:** For a comprehensive treatment of *S. purpurea*, see Meikle (1984). In Tasmania, only female *S. purpurea* plants are recorded. This species

is distinguished from other Tasmanian willows by the combination of its shrubby habit and long, narrow leaves. Other distinctive characteristics include the leaves, stems and catkins often being borne in opposite to sub-opposite pairs. The bark of *S. purpurea*, when peeled away from the wood, is yellow underneath and is very bitter to taste. The stems of this species are tough and flexible and are used for basket making.

**Distribution and habitat:** *Salix purpurea* has a widespread native distribution throughout Europe, western Asia and northern Africa, growing in wet habitats such as river margins. The species is naturalised in Australia, New Zealand, Canada and the United States of America. In Australia, it is naturalised in New South Wales and Victoria and is represented by several cultivars of both sexes (Cremer 1995; Cremer *et al.* 1995). There it was planted for erosion control on the banks of rivers and roadside batters (Cremer *et al.* 1995; Carr 1996). In New Zealand, it was introduced for soil stabilisation, as well as for basket making (Sykes 1988). In Tasmania, it has been planted occasionally for stream bank stabilisation and for ornament. It is not known whether this species is naturalised in Tasmania or if all plants have been planted. For example, at the Oldina Forest Reserve in the North-West region of the state, approximately 400 m of creek line is dominated by *S. purpurea*. It was originally planted at this site but it is not known how much of the current population was planted. Monitoring would be required to determine if the species is spreading at this and other sites.

**First record:** 2004, M.L. Baker.

**Specimens examined:** **TASMANIA:** Royal Tasmanian Botanical Gardens, 4.iii.2004, M.L. Baker 389 & N. Papworth (HO); Oldina picnic area/forest reserve, 3.xi.2004, M.L. Baker 989 & M.F. Duretto (HO, MEL); just below Winkleigh bridge, ii.2005, M. Askey-Doron *s.n.* (HO). **NEW SOUTH WALES:** Numeralla River, c. 14 km south of Bredbo on Cooma Road, 11.x.1995, S.W.L. Jacobs 7877 (NSW, MEL). **VICTORIA:** Ovens River, c. 11 km west of Myrtleford, 13.x.1995, S.W.L. Jacobs 7908 & 7909 (MEL, NSW). **POLAND:** Wieliczka, ATPOL square DF69, 30.viii.2004, J. Zelozny *s.n.* (HO, KRA).

### 13. *Salix humboldtiana* Willd. 'Pyramidalis'

**Previously misapplied name:** *S. chilensis* Molina (Meikle 1990; Carr 1996; Spencer 1997)

**Common name:** Pencil Willow

**Illustration:** Fig. 1M

**Trees** 10–15 m tall. **Branches** very erect, forming a fastigiate crown. **Bark** smooth. **Stems** glabrous or occasionally with a few hairs, dark brown to olive-green, sometimes reddish. **Bud scales** 2, free along inner margin. **Stipules** small, auriculate, glandular-toothed, caducous. **Leaves** at first pubescent, soon becoming glabrous, linear, 50–150 mm long, 5–10 mm wide, glossy green on both surfaces but slightly paler abaxially; margin finely glandular-serrulate; apex acute; petiole 1–1.5 mm long. **Catkins** (not seen on Tasmanian material) appearing with the leaves on short lateral shoots. **Male catkins** 30–100 mm long, 6–10 mm wide, spreading to erect; peduncle up to 12 mm long; bracts ovate, 2–3 mm long, yellow, pilose; stamens 5–8(–14), exceeding bracts in length, pilose in proximal half. **Female catkins** not known in Australia.

**Discussion:** For a comprehensive description, see Rodriguez *et al.* (1983); flower and catkin characters given above have been taken from this source. This taxon is immediately distinguished from other willows by its very tall and narrow crown. In Tasmania, catkins have never been observed, and plants commonly retain their leaves throughout winter when most other willows are leafless. According to Dorn (1976) and Rodriguez *et al.* (1983), the name *S. chilensis* Molina, used by various authors (including Meikle 1990; Carr 1996; Spencer 1997) and encountered in the nursery industry, has been wrongly applied to this taxon.

**Distribution and habitat:** *Salix humboldtiana* is native to Central and South America where it grows from Mexico through to Chile. The fastigiate form originates from the Copiapó province, northern Chile (Rodriguez *et al.* 1983). In Australia, *S. humboldtiana* 'Pyramidalis' is a common garden plant, especially in coastal areas of Queensland, New South Wales and Victoria (Carr 1996; Spencer 1997). It is naturalised to a very limited extent in Queensland and New South Wales (Jacobs & Murray 2000; Bostock & Holland 2007). In Tasmania, this taxon is commonly cultivated and has never been recorded outside of cultivation.

**First record:** 2004, M.L. Baker.

**Specimens examined:** **TASMANIA:** Royal Tasmanian Botanical Gardens, Hobart, 4.iii.2004, M.L. Baker 391 & N. Papworth (HO); Grosvenor Street, Sandy Bay, Hobart, 15.xii.2006, M.L. Baker 1768 & A.M. Buchanon (HO).



## Additional Taxa Recorded

Additional uncommon *Salix* taxa have been recorded for Tasmania, by the author and from records held by the Royal Tasmanian Botanical Gardens, but as they are entirely restricted to cultivation, they are not treated here. These taxa include: *S. alba* L. var. *caerulea* (Sm.) Sm., *S. gracilistyla* Miq. var. *melanostachys* (Makino) C.K. Schneid., *S. fargesii* Burkill, *S. caprea* L. 'Weeping Sally', *S. petrophila* Rydb., *S. hastata* L. 'Wehrhahnii', *S. helvetica* Vill., *S. lanata* L., *S. myrtilloides* L. 'Pink Tassels', *S. repens* L. var. *argentea* (Sm.) Wimm. & Grab., *S. retusa* L. and *S. serpyllifolia* Scop. No doubt numerous other taxa are in cultivation in Tasmania.

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